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FOREIGN DOCUMENTS OR RADIO BROADCASTS

REPORT

CD NO.

50X1-HUM

COUNTRY	USSR	DATE OF INFORMATION	1949
SUBJECT	Technological - Cutting tools		
HOW PUBLISHED	Monthly periodical	DATE DIST.	12 Oct 1949
WHERE PUBLISHED	Moscow	NO. OF PAGES	2
DATE PUBLISHED	Aug 1949	SUPPLEMENT TO REPORT NO.	
LANGUAGE	Russian		

THIS IS UNEVALUATED INFORMATION

SOURCE Stanki i instrument, No 8, 1949.

FUSING HIGH-SPEED STEEL ON CUTTING TOOLS

Fusing high-speed steel tips on tools has not been widely adopted because the technological process which would give adequate stability to the tool being fused has not been sufficiently developed. However, satisfactory results have been achieved in fusing large section cutters, reamers and millers according to a method described below.

Types RFI and R high-speed steel are used for fusing and the holders are made from steel U7 and 1045. Fusion is carried out with the aid of an oxyacetylene flame having varying degrees of reducing power; with the length of the flame core at 30, 40, 50, 70, and 90 millimeters, torch tips No 3, 4 and 5 are used.

Welding rods are forged from high-speed steel scrap at a temperature of 1,175 - 950 degrees. The size of rods for cutters is 5 x 8 millimeters; for milling cutters and reamers, 4 x 6 millimeters. After forging and mechanical cutting, the short rods are sand blasted and welded together into rods 400 millimeters long.

Holders for millers and reamers are manufactured from steel U7. Holders from steel 1045 have brought negative results due to tooth shrinkage after hardening and formation of ribs on the surface of the millers when rubbing against the part being machined.

The high-speed steel fused coating must contain 0.67 - 0.75 percent carbon. For this reason, the composition of the combustible mixture is selected with a surplus of acetylene for liberating free carbon in the form of minute particles ($2C_2H_2+O_2 = 2CO+2H_2+C_2$) which dissolve in the molten metal. In practice, it is difficult to regulate the flow of oxygen and acetylene in correct proportions. For this reason, the required flame is determined by measuring its core with a gage (shablon). This simplifies the process of checking the flame during operation. According to experiments which have been conducted, it has been established that, to safeguard the chemical composition of high-speed steel welding rods, a reducing flame with a 30 - 35 millimeter long core should be used. Thus, the fused metal does not have blisters or slag impurities and the surface of the fusion is smooth. When this process is repeated, without added metal filler, and as the multilayers are fused, there is no change in the chemical composition, if the above conditions are maintained.

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Multilayer fusion, which shows considerable slag impurities and pores in the beginning of the operation, has good surface quality after smoothing off. For this reason it is recommended that the fusing be accomplished in one continuous operation, with subsequent smoothing off of the final surface.

The fusing of high-speed steel on the holder is similar to soldering; the surface of the holder is melted to a very slight depth, 0.3 millimeter and less. This assures complete adhesive stability.

The surface of the holder is preheated with an inert flame. As it approaches the melting point, a moving, glittering spot appears which follows the tongue of the flame. This, in practice, serves to indicate that the required temperature has been reached. At this moment it is necessary to regulate the reducing flame to a 30 - 35 millimeter core and to again bring the heated surface of the holder to final heating until it reaches the melting point. Then, drops of high-speed steel running from the end of the welding rod, which is heated by the jet of the flame, are applied to the holder. This process continues until the required fused coating is achieved. Fusing must be accomplished rapidly to avoid overheating. The torch must be held at a 45-degree angle and the welding rod at 30 - 45 degrees to the surface being fused.

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